Effect of Inoculum Placement on Distribution of Nodules in *Phaseolus vulgaris* L.

Robert A. Henson and Eliane Lopes

EMBRAPA/CNPAF, Caixa Postal 179, 74000 Goiânia, Goiás, Brazil
Current address (RAH): INIAP - Est. Exp. Sta. Catalina
Casilla Postal 340, Quito, Ecuador

Introduction.

In 1987, the microbiology project at the EMBRAPA National Center for Research on Rice and Beans (CNPAF) began participating in a CNPAF multidisciplinary project to develop viable bean production technologies for the Rio Formoso Cooperative, Formoso do Araguaia, Goiás (now Tocantins), Brazil. On the Rio Formoso floodplain, winter crops (beans or soybeans) are produced with subirrigation.

In the first field experiment, no nodules were produced in the treatments which were not inoculated with *Rhizobium leguminosarum* biovar *phaseoli* strain CIAT 899 (Moura, et al., 1989). Visual observations of the root systems during vegetative growth showed a tendency for nodules to be formed in clusters. Since the inoculum had been applied in granular form in the row at planting, it was hypothesized that the movement/growth of rhizobium in the soil had been minimal and that nodules were only found on sections of root which had grown in close proximity to a granule of inoculum.

The objectives of this experiment were to collect preliminary information on the mobility of *Rhizobium leguminosarum* bv. *phaseoli* when applied as inoculum and to determine promising methods of inoculation for field testing in the next planting season at Rio Formoso.

Materials and Methods.

The experiment was installed in 2-liter pots in a glasshouse at EMBRAPA/CNPAF, Goiânia, Goiás, with soil from the Rio Formoso floodplain. Treatments included identical masses of inoculum (CIAT 899 in a peat carrier) applied to each pot as follows: a) directly below the seed, b) uniformly mixed with the soil, or c) divided among four uniformly-spaced sites midway between the seed and the pot wall and midway between the soil surface and the bottom of the pot. A control treatment with no inoculum was also included and all treatments were replicated four times in a completely randomized design. Pots were sown with bean genotypes Rio Tibagi and WBR 22-8, placed on plates, and subirrigated by adding water to the plates as needed. At approximately three weeks after emergence, root systems were excavated to observe the presence and distribution of nodules.

Results.

Rhizobial contamination was minimal as evidenced by only occasional greenish nodules at the bottom of control and inoculated pots. Control treatments contained no other nodules. In the treatments where inoculum was applied to specific sites in the pot, nodules were produced in clusters corresponding to the site(s) of application. When the inoculum was uniformly mixed with the soil, nodulation was dispersed and more uniformly distributed along the roots. Nodule distribution did not vary with host genotype.

Discussion.

The visual observations of nodulation in this experiment indicate little or no movement of rhizobium in subirrigated soil during the first three and one-half weeks after inoculation. More movement may occur under surface-irrigated or rainfed conditions, where water moves through the soil profile by gravitational rather than capillary flow.

These results also suggest that the best method of inoculation under subirrigated conditions is a uniform application to the soil. This could possibly be accomplished by broadcasting inoculum at the time of soil preparation. Seed inoculation at planting in addition might improve early-season nodulation and plant growth similar to a starter application of N fertilizer.

Reference.

Moura, J. R.A. Henson, and P.A.A. Pereira. 1989. Inoculation effect on N2 fixation in Phaseolus vulgaris L. in low-land soil in Brazil. Ann. Report of the Bean Improvement Coop. 32:50-51